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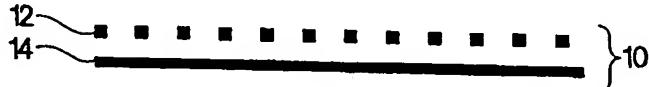
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(54) Title: PRESSURE SENSITIVE ADHESIVE STRUCTURES FOR CONSTRUCTION

(57) Abstract

A pressure sensitive adhesive structure including a dry, pressure sensitive adhesive coated on a release liner is described. The pressure sensitive adhesive structure can be used to secure building materials, such as roofing membranes or high pressure laminates, to substrate surfaces.



PRESSURE SENSITIVE ADHESIVE STRUCTURES FOR CONSTRUCTION

Background Of The Invention

The invention relates to pressure sensitive adhesive structures for use in home construction.

5 Adhesives are widely used in construction applications. For example, in home construction, the fabrication of roofing systems (i.e., a roofing membrane on a roofing underlayment) or high pressure laminate surfaces (i.e., counter tops, display cases, furniture, etc.), typically involves use of an adhesive to bond the surface covering layer to a substrate. The liquid or paste adhesive is typically applied to a substrate followed by contact of the covering 10 layer to the substrate.

Single ply roofing membranes are generally made of a water repellent material that can be manufactured in large rolls and subsequently rolled onto the roofing underlayment. The membranes can be tar paper (densified kraft impregnated with asphalt), EPDM rubber, reinforced PVC, reinforced polyolefin, or a variety of laminated materials. The roofing membranes are 15 generally attached to the roofing underlayment by mechanical and chemical methods.

High pressure laminates often are composed of a phenolic resin that can be manufactured in large sheets, typically 4 foot by 8 foot or 4 foot by 12 foot, and subsequently applied to a specific substrate, typically plywood or industrial grade particle board, by chemical methods (i.e., using a liquid contact adhesive). The high pressure laminate can be, for example, a phenolic 20 resin coated onto a kraft substrate and subsequent layers of melamine built upon each other until the desired thickness and stiffness is achieved.

Mechanical methods of attaching roofing membranes utilize metal screw fasteners that penetrate the roofing membrane and anchor into the roofing underlayment.

Chemical methods of attaching roofing membranes employ a liquid contact adhesive. The 25 adhesive is applied and allowed to dry for a predetermined amount of time. Dry time is determined by the nature of the formulation and the solvents content of the adhesive. There is a critical time period during the drying process when the adhesive is usable and forms a strong bond between materials. If the adhesive is not allowed to dry sufficiently before contacting the materials, excess solvent will be trapped between the layers of bonded materials, which may 30 expand upon vaporization and cause failure of the bond. If the adhesive is allowed to dry excessively, then the two layers will become non-tacky, resulting in insufficient adhesion and a weak bond.

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The adhesive is generally applied by brush, roller, swab, or spray. The covering layer (i.e., roofing membrane or high pressure laminate) is then laminated to the corresponding roofing underlayment which may also have been covered with adhesive and allowed to dry. Even pressure from a roller or device (e.g., a push broom) forces out any entrapped air and facilitates

5 the adhesive bond between the covering layer and the substrate. The seams of the roofing membrane can be heat welded or utilize a chemical splicing cement.

In the roofing industry, asphalt is commonly used as the adhesive, which is heated to a molten state and then swabbed down onto the roofing surface. Other liquid adhesive formulations include natural and synthetic rubbers have been formulated with resins in organic solvent

10 systems. Liquid adhesives are also generally used for adhering high pressure laminates to substrates.

Summary of the Invention

In general, the invention features a pressure sensitive adhesive structure that includes a

15 dry, pressure sensitive adhesive coated on a release liner that can be used to bond a variety of building materials (e.g., a covering layer to a substrate surface). The pressure sensitive adhesive structure can be used, for example, to secure membranes to a roofing underlayment or a high pressure laminate to a substrate surface. The dry, pressure sensitive adhesive structure can be transferred directly to the underside of a covering layer (e.g., a single ply roofing membrane or

20 high pressure laminate) using pinch pressure while the covering layer is being manufactured. Alternatively, it can be used in a secondary adhering process.

In one aspect, the invention features an adhesive structure including a pressure sensitive adhesive and a release liner on one side of the pressure sensitive adhesive. The pressure sensitive adhesive can be capable of forming a bond between a covering layer and a substrate. The

25 covering layer can be a high pressure laminate or polymer membrane. The pressure sensitive adhesive can have a peel force substantial enough to cause a high pressure laminate adhered to a plywood surface to break if removal of the laminate from the plywood is attempted in a temperature range of 0 to 250°F. In other embodiments, the pressure sensitive adhesive can include a cross-linking agent capable of forming a bond with a hydroxyl surface functionality,

30 which can be on the covering layer or the substrate.

The adhesive structure can be produced by a liquid, pressure sensitive adhesive to a surface of a release liner and curing the liquid, pressure sensitive adhesive on the release liner to

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produce a dry, pressure sensitive adhesive. The release liner can be coated with a polysiloxane to adjust the release characteristics of the liner before applying the liquid, pressure sensitive adhesive.

The adhesive structure can be applied, for example, to the covering layer (e.g., a polymer membrane or high pressure laminate) to form a single ply roofing membrane structure or a high pressure laminate adhesive structure. These structures have a release liner on one side of the pressure sensitive adhesive and the covering layer on the pressure sensitive adhesive opposite the release liner.

In another aspect, the invention features a method of adhering a covering layer to a substrate. The method includes the steps of removing a release liner from one side of the pressure sensitive adhesive to expose a surface of the pressure sensitive adhesive, contacting the surface of the pressure sensitive adhesive with a surface of a substrate, and applying pressure to the pressure sensitive adhesive to form a bond between the covering layer and the substrate.

The adhesive structure can simplify adhering surfaces together by using a dry adhesive. It may be possible to reduce, or preferably eliminate, the use of mechanical fasteners or liquid contact adhesives, which can simplify installation processes improve the consistency of the adhesive application. Application of liquid adhesives can be viscosity sensitive and can result in variation in product performance due to environmental conditions, poor adhesive bonds due to inaccurate application rates, production down time while waiting for the adhesive to dry, and variable cure times. The adhesive structure may be provided directly in a roll form which can allow it to be readily used on the construction site or in automated manufacturing without the need to make significant changes to existing manufacturing machinery and processes. Other advantages and features of the invention will be apparent from the detailed description, and from the claims.

25

Brief Description of the Drawing

FIG. 1 is a schematic drawing depicting a cross-sectional view of a pressure sensitive adhesive structure.

FIG. 2 is a schematic drawing depicting a cross-sectional view of a covering layer including the pressure sensitive adhesive structure.

FIG. 3 is a schematic drawing depicting a cross-sectional view of a single ply roofing membrane or high pressure laminate including the pressure sensitive adhesive structure.

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FIG. 4 is a schematic drawing depicting a process of manufacturing the pressure sensitive adhesive structure.

FIG. 5 is a schematic drawing depicting a process of applying the pressure sensitive adhesive structure to a covering layer.

5

Description of the Preferred Embodiments

Referring to FIG. 1, the pressure sensitive adhesive structure 10 includes a layer of a dry, pressure sensitive adhesive 12, and a release liner 14 disposed on one side of adhesive layer 12. Release liner 14 can protect one surface of adhesive layer 12 until it is removed to bond with a 10 substrate.

The adhesive layer 12 can be a multiple component, solvent-based adhesive system or a water-based adhesive system, preferably solvent-based. The primary adhesive component can be, for example, an acrylic adhesive such as a polymerized form of vinyl acrylate and 2-ethylhexyl acrylate or a rubber adhesive, such as styrene-butadiene rubber, styrene-isoprene-styrene block 15 copolymer, butyl rubber, neoprene, isoprene, or a mixture thereof. The adhesive can also include a resin system such as phenolic, terpene, or a hydrocarbon tackifying resin (e.g., CS).

In liquid form, the pressure sensitive adhesive can include a solvent. Suitable solvents include ethyl alcohol, toluene/heptane, hexane, or any other solvents capable of dissolving an acrylic resin. The solvent content of the solvent-based adhesive can be, for example, in a range 20 from about 45% to about 65%. The viscosity of the solvent-based adhesive may be between about 2,000 and 10,000 centipoise, preferably between about 4,000 and 6,000 centipoise. In dry form, the pressure sensitive adhesive can contain, for example, less than one percent solvent.

The peel adhesion of the adhesive is between about 2.5 and 3.5 pounds per inch when measured at one mil and tested in accordance with Pressure Sensitive Tape Council (PSTC) test 25 PSTC-1, which uses stainless steel plates as a standard testing substrate. The William's plasticity Index of the cured adhesive is typically between about 3.0 and about 5.0 millimeters, as determined by ASTM-D926. Suitable solvent-based adhesives include, for example, Avery 351-HVX (Avery Dennison of Mill Hall, Pennsylvania) for roofing membrane applications or Polytac 414X2.2 (H&N Chemical of Totowa, NJ) for high pressure laminate applications.

30 Adhesive layer 12 can have a thickness between 1 mil and 10 mils, preferably between 3 mils and 6 mils, and more preferably between 4 mils and 5 mils.

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The adhesive can include a cross-linking agent that is capable of cross-linking with surface functionalities (e.g., hydroxyl groups) of the covering layer or the substrate. The cross-linking agent can include a multifunctional monomer having an isocyanate, epoxide, or other functionality capable of reacting with surface hydroxyl groups. The cross-linking agent can be, 5 for example, methyl diphenylisocyanate. The isocyanate functionality reacts with surface hydroxyl groups for form carbamate (i.e., urethane) linkages. The cross-linking agent gives the adhesive stability against agents (i.e., plasticizers) that can leach out of the covering layer and degrade the adhering properties of the adhesive. The polymer membrane of the single ply roofing membrane can have plasticizers; the stability of the adhesive bond in the single ply roofing 10 membrane is enhanced by the cross-linking agent.

The pressure sensitive adhesive for adhering the high pressure laminate can have a peel force substantial enough to cause a high pressure laminate adhered to a plywood surface to break if removal of the laminate from the plywood is attempted at temperatures between 0 and 250°F. The adhesive for adhering high pressure laminates can also be water, chemical, temperature, and 15 mold resistant.

The pressure sensitive adhesive also may include other additives, such as solvents, stabilizers, surfactants, preservatives, dispersants, and defoamers. The stabilizer can provide the adhesive with freeze-thaw stability. One suitable stabilizer is ethylene glycol. The surfactant can be a non-ionic surfactant. The preservative (e.g., an organic preservative) can inhibit growth of 20 algae, fungi, or bacteria. Dispersants can be an aromatic sulfonic acids and salts thereof, polycarboxylic acids, or inorganic polyphosphates. The defoamer can facilitate handling of the adhesive, such as mixing by reducing bubbling and foaming. Release liner 14 can be formed of a conventional release material. For example, release liner 14 can be a paper or film coated with a single layer of polysiloxane for altering the release characteristics of the liner. One preferred 25 material for release liner 14 is a polysiloxane-coated paper having a release of about 30 grams per inch according to test procedure PSTC-4 (e.g., Rexam Release grade 1170 S 76#BL KFT L/L 4D/4F, available from Rexam of Bedford Park, IL).

Referring to FIG. 2, adhesive structure 10, having a dry, pressure sensitive adhesive layer 12 and release liner 14, can be applied to the surface of covering layer 16 to form adhesive 30 covering layer 20. Alternatively, a liquid, pressure sensitive adhesive layer 12 can be applied to a surface of covering layer 16 which is dried and covered with release liner 14. Covering layer 16 is the component which can be bonded to a substrate using an adhesive. Covering layer 16 can be, for example, a high pressure laminate or a polymer membrane which can function as a single

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ply roofing membrane. The polymer membrane can include a polyethylene, polypropylene, an ethylene-propylene copolymer, polyvinyl chloride, Hypalon (DuPont), a copolymer alloy with Elvaloy plasticizer (an ethylene copolymer, DuPont), nitrilebutadiene copolymer, polyisobutylene, a thermoplastic olefin, an ethylene interpolymer, or combinations thereof. The 5 high pressure laminate can include a top layer, a reinforcement layer, and a bottom layer (e.g., Formica).

Release liner 14 can be removed to expose pressure sensitive adhesive layer 12 which can be pressed onto a substrate surface to bond covering layer 16 to the substrate. Adhesive layer 12 preferably bonds to covering layer 16 with sufficient strength to prevent lifting of the covering 10 layer (e.g., roofing membrane or high pressure laminate) from the substrate (e.g., roofing underlayment or plywood backing) during adverse conditions.

Referring to FIG. 3, covering layer 16 can include bottom layer 22, reinforcement layer 24, and top layer 26 and adhesive structure 10 to form reinforced adhesive covering layer 30. A surface of bottom layer 22 is bonded to adhesive layer 12 of adhesive structure 10 opposite 15 release layer 14.

Adhesive structure 10 can be manufactured in a continuous process. Referring to FIG. 4, release liner 14 is provided by release liner roll 40. Release liner 14 passes through coating head 42 which applies the liquid pressure sensitive adhesive to one side of release liner 14. The coated liner passes through curing ovens 44, which can cure and dry the pressure sensitive adhesive to 20 form adhesive structure 10. Adhesive structure 10 exits the ovens and can be spooled into an adhesive structure roll 46. Alternatively, adhesive structure 10 can be laminated directly to a covering layer.

Adhesive structure 10 can be applied to a surface by exposing a surface of the pressure sensitive adhesive to a second surface (e.g., a substrate or a covering layer) and applying pressure 25 to seal the adhesive and bonding the adhesive to the surface. The adhesive structure 10 can be used directly at the construction site to bond two surfaces together or at a manufacturing site to form an adhesive covering layer. For example, single ply roofing membrane having the structure 20 can be laid onto a roof and smoothed out after removal of the release layer. Each row of single ply roofing membrane can be overlapped with the next row and the overlapped portion can be 30 welded together. In another example, high pressure laminate having the structure 20 can be laid onto a substrate and pressed down to bond the structures together.

Referring to FIG. 5, adhesive structure can be laminated to a surface of a covering layer is a continuous process. Adhesive structure 10 is provided by adhesive structure roll 46. The

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adhesive surface of adhesive structure 10 contacts a surface of covering layer 16 and the two layers pass between driven rollers 50 and nip rollers 52.

The rollers 50 and 52 apply pressure to the two layers and bond adhesive structure 10 to covering layer 16 to form adhesive covering layer 20. The exiting adhesive covering layer 20 can 5 be cut into sheets or rolled into a roll for transport to the construction site.

The following are specific examples of the manufacture and use of the pressure sensitive adhesive structure.

Example 1

The adhesive used to prepare the pressure sensitive adhesive structure for the single ply 10 roofing membrane is a solvent-based acrylic adhesive (Avery 351-HVX) having a solids content of 39+/-2 weight percent. For roofing membranes that contain plasticizers, it can be beneficial to add a small percentage of methyl diphenylisocyanate as a crosslinking agent, such as Pappi (Monsanto) . The adhesive is applied via a reverse roll coating head system fed by a level- activated air assist pump. The adhesive is pumped from 55 gallon drums through a piping system 15 into the coating head. The adhesive level control is closed looped with the air assist pump. As the level of adhesive diminished, the air is activated to refill the reservoir at the coating head.

The adhesive is cast onto the release liner via the reverse roll coating head system. The amount of adhesive cast onto the silicone release paper is determined by the gap between the metering roll and the backing roll and the speed of the metering roll. The adhesive is cast onto 20 the tight side of the release liner.

The release liner (4P Follie, Germany) has silicone coatings 368 on one side and 478 on the other side. 368 and 478 are polysiloxanes containing different amounts of a control release agent. The release coating 368 has an easy release while release coating 478 has a tighter release. For this reason the 478 side of the release liner is coated directly with the adhesive, allowing the 25 cured adhesive to be wound into a roll and subsequently unwound without tearing the adhesive layer.

The adhesive is cured and dried in an oven. The curing and drying conditions (e.g., temperature and time of exposure) are adjusted according to line speed and oven length.

As the cast adhesive on the release liner exits the oven, the adhesive should be fully or 30 nearly fully dried. If the adhesive is not fully dried, the excess amount of solvent can lead to a noxious odor, poor release characteristics, soft adhesive in roll form, tearing of the adhesive layer when unrolling, and poor shear adhesion characteristics. The adhesive is preferably dried to a minimum solvent content of 1%. Drying can be controlled, for example, by temperature, air

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velocity, line speed, or a combination thereof. The adhesive deposition thickness and solids content can vary the drying profile.

As the coated release liner exits the oven, it is passed over a variety of rollers that guide the material and cool it down prior to rewinding. Static discharge can create a defective area in 5 the silicone release liner which can damage the adhesive when the material is unwound. Static elimination equipment, such as, for example, brass tinsel or nuclear bars, located at the oven exit and rewinding web path can help eliminate static build up in the material. The material is rewound with a book edge type roll configuration such that each layer overlaps the layer below within an offset tolerance of 1/64 inch.

10 This master roll (e.g., 40 inches wide and 36 inches in radius) of adhesive can be cut to the appropriate width for laminating to the roofing membrane. For example, two 36 inch rolls can be used to laminate to a 78 inch membrane. The excess membrane edge is heat welded and does not need adhesive.

Example 2

15 The adhesive used to prepare the pressure sensitive adhesive structure for the high pressure laminate is a solvent-based acrylic adhesive (Polytac 414 x 2.2) having a solids content of 59.5+/- weight percent. The adhesive is applied to the release liner via a reverse roll coating head system onto the tighter release side of the release liner, as described in Example 1.

20 This master roll of adhesive can be cut to the appropriate width for laminating to the high pressure laminate. For example, forty-eight, thirty-six, and twenty our inch widths can be common.

Example 3

25 The single ply roofing membrane is laminated to the adhesive of the master roll described in Example 1. Both the adhesive master roll and single ply roofing membrane are supported on a machine capable of unwinding, guiding, laminating, and rewinding the finished laminated product.

30 The unwinding stations for the adhesive master roll and single ply roofing membrane are similar. The unwind station can be equipped with an adjustable chuck for locking and holding of the master roll of material, for example, when lowered in place from an overhead crane or a fork truck. The chuck can also be controlled with some type of breaking system (e.g., mechanical or electrical) to create the desired amount of tension on the unwinding web.

The web path consists of a sufficient number of idle S rollers to guide the material through the unwinding station and into the laminating station. The laminating station consists of two nip

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rollers which control the speed and of the two webs coming in to the rollers. The nip rollers apply adequate pressure to laminate the materials together. The two laminating station rollers can be speed and pressure controlled via mechanical or electrical devices. A closed loop feedback system can regulate break pressure at each unwind station to control web tension.

5 Upon exiting the lamination station, the materials adhere to one another in a consistent and uniform manner. The laminated materials can generally be free of wrinkles, air pockets, and other defects. The laminated materials then pass through idler and guide rolls to maintain a straight and taught web.

10 The rewinding station consists of a framework capable of holding and moving at least 2,000 pound rolls of material with a book edge type roll configuration.

 The resulting master roll consists of a single ply roofing membrane laminated with the pressure sensitive adhesive having a silicone release liner protective covering.

Example 4

15 The high pressure laminate is laminated to the adhesive of the master roll described in Example 2. The lamination process for the adhesive structure and high pressure laminate is similar to that described in Example 3. As an alternative to rolling, the laminated material passes through a cutting station where the adhesive can be cut to the desired size of the high pressure laminate. The laminated material can be stacked and packaged appropriately.

Example 5

20 The single ply roofing membrane laminated with pressure sensitive adhesive and covered with a protective silicone coated paper described in Example 3 can be utilized in the following manner. In certain flat roofing applications, the underlayment of the roof can be aluminum foil-covered or felt-covered isocyanurate insulation boards (e.g., Celotex) that is 4 feet wide, 8 feet long, and 2 inches thick. Each isocyanurate board can be held in place mechanically with screws 25 and large retaining washers that attach directly into the roofing members.

 The single ply roofing membrane laminated with pressure sensitive adhesive and covered with a protective silicone coated paper in master roll form (Example 3) when applied to the roof. The material is rolled out onto the roof in the area that it is to be laminated. One half of the material is folded back and the release liner is removed. The adhesive exposed on half the 30 membrane is laid into place. The material is smoothed out over the roof with a push broom. The other half of the membrane is folded back and the release liner removed. The adhesive exposed on this half of the membrane is laid into place onto the underlayment and the material is smoothed out with a push broom. The membrane is permanently bonded to the roofing

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underlayment. Once the release liner is removed, care must be taken to apply the membrane in the correct position since it can be difficult to reposition the membrane once the adhesive contacts the roofing underlayment.

Example 6

5 The pressure sensitive adhesive laminated to a sheet of high pressure laminate described in Example 4 is generally obtained in sheet form (e.g., 4 foot by 8 foot or 4 foot by 12 foot). The back of each sheet is fully covered by the pressure sensitive adhesive with a silicone release liner protective covering attached. The high pressure laminate is roughly cut to the size needed to cover a surface.

10 The release liner is removed immediately prior to the application of the high pressure laminate to the substrate. After the high pressure laminate is laid in place, it is rolled with a hand roller to remove any entrapped air and to set the adhesive bond to the substrate. Once set, the edges can be routed to finish the top. Additional sides may also be laminated and routed to adjoining surfaces.

15 Other embodiments are within the claims. For example, the adhesive structure can be used to bond other construction elements together.

What is claimed is:

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CLAIMS

1. An adhesive structure comprising:
 - a pressure sensitive adhesive including a cross-linking agent capable of forming a covalent bond with a hydroxyl surface functionality; and
 - 5 a release liner on one side of the pressure sensitive adhesive.
2. The adhesive structure of claim 1, wherein the cross-linking agent is an isocyanate or an epoxide.
- 10 3. The adhesive structure of claim 1, wherein the pressure sensitive adhesive includes a rubber adhesive.
4. The adhesive structure of claim 1, wherein the pressure sensitive adhesive includes an acrylic adhesive.
- 15 5. The adhesive structure of claim 1, further comprising a polymer membrane on the adhesive layer opposite the release liner.
6. An adhesive structure comprising:
 - 20 a pressure sensitive adhesive having a peel force substantial enough to cause a high pressure laminate adhered to a plywood surface to break if removal of the laminate from the plywood is attempted in a temperature range of 0 to 250°F; and
 - a release liner on one side of the pressure sensitive adhesive.
- 25 7. The adhesive structure of claim 6, wherein the pressure sensitive adhesive includes a rubber adhesive.
8. The adhesive structure of claim 6, wherein the pressure sensitive adhesive includes an acrylic adhesive.
- 30 9. The adhesive structure of claim 6, further comprising a high pressure laminate on the adhesive layer opposite the release liner.

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10. A method of producing an adhesive structure comprising:
applying a liquid pressure sensitive adhesive to a surface of a release liner; and
curing the liquid pressure sensitive adhesive on the release liner to produce a dry pressure
sensitive adhesive,

5 wherein the dry pressure sensitive includes a cross-linking agent capable of forming a
covalent bond with a hydroxyl surface functionality.

11. The method of claim 10, further comprising coating the surface of the release liner with a
polysiloxane before applying the liquid pressure sensitive adhesive.

10 12. The method of claim 10, wherein the dry pressure sensitive adhesive includes an acrylic
adhesive.

15 13. The method of claim 10, wherein the dry pressure sensitive adhesive includes an rubber
adhesive.

14. The method of claim 10, wherein the cross-linking agent is an isocyanate or an epoxide.

15 15. The method of claim 10, further comprising applying a covering layer on the adhesive
20 layer opposite the release liner.

16. The method of claim 15, wherein the covering layer is a polymer membrane.

17. A method of producing an adhesive structure comprising:
25 applying a liquid pressure sensitive adhesive to a surface of a release liner; and
curing the liquid pressure sensitive adhesive on the release liner to produce a dry pressure
sensitive adhesive,
wherein the dry pressure sensitive adhesive has a peel force substantial enough to cause a
high pressure laminate adhered to a plywood surface to break if removal of the laminate from the
30 plywood is attempted in a temperature range of 0 to 250°F.

18. The method of claim 17, further comprising coating the surface of the release liner with a
polysiloxane before applying the liquid pressure sensitive adhesive.

19. The method of claim 17, wherein the dry pressure sensitive adhesive includes an acrylic adhesive.
- 5 20. The method of claim 17, wherein the dry pressure sensitive adhesive includes a rubber adhesive.
21. The method of claim 17, further comprising applying a covering layer on the adhesive layer opposite the release liner.
- 10 22. The method of claim 21, wherein the covering layer is a high pressure laminate.
23. A single ply roofing membrane comprising: a pressure sensitive adhesive including a cross-linking agent capable of forming a covalent bond with a hydroxyl surface functionality; a release liner on one side of the pressure sensitive adhesive; and a polymer membrane on the pressure sensitive adhesive opposite the release liner.
- 15 24. The single ply roofing membrane of claim 23, wherein the pressure sensitive adhesive includes an acrylic adhesive.
- 20 25. The single ply roofing membrane of claim 23, wherein the pressure sensitive adhesive includes a rubber adhesive.
26. The single ply roofing membrane of claim 23, wherein the cross-linking agent is an isocyanate or an epoxide.
- 25 27. The single ply roofing membrane of claim 23, wherein the polymer membrane comprises polyethylene, polypropylene, an ethylene-propylene copolymer, or polyvinyl chloride.
- 30 28. A method of manufacturing a single ply roofing membrane comprising: applying a pressure sensitive adhesive including a cross-linking agent and having a release liner on one side of the adhesive layer to a polymer membrane,

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wherein the cross-linking is capable of forming a covalent bond with a hydroxyl surface functionality.

29. The method of claim 28, wherein the pressure sensitive adhesive includes an acrylic
5 adhesive.

30. The method of claim 28, wherein the pressure sensitive adhesive includes a rubber adhesive.

10 31. The method of claim 28, wherein the cross-linking agent is an isocyanate or an epoxide.

32. The method of claim 28, wherein the polymer membrane comprises polyethylene, polypropylene, an ethylene-propylene copolymer, or polyvinyl chloride.

15 33. A high pressure laminate adhesive structure comprising:
a pressure sensitive adhesive having a peel force substantial enough to cause a high pressure laminate adhered to a plywood surface to break if removal of the laminate from the plywood is attempted in a temperature range of 0 to 250°F;
a release liner on one side of the pressure sensitive adhesive; and
20 a high pressure laminate on the pressure sensitive adhesive opposite the release liner.

34. The high pressure laminate adhesive structure of claim 33, wherein the pressure sensitive adhesive includes an acrylic adhesive.

25 35. The high pressure laminate adhesive structure of claim 33, wherein the pressure sensitive adhesive includes a rubber adhesive.

36. The high pressure laminate adhesive structure of claim 33, wherein the high pressure laminate comprises a top layer, a reinforcement layer, and a bottom layer.

30
37. A method of manufacturing a high pressure laminate adhesive structure comprising:
applying a pressure sensitive adhesive having a release liner on one side of the pressure sensitive adhesive to a high pressure laminate,

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wherein the pressure sensitive adhesive has a peel force substantial enough to cause a high pressure laminate adhered to a plywood surface to break if removal of the laminate from the plywood is attempted in a temperature range of 0 to 250°F.

5 38. The method of claim 37, wherein the pressure sensitive adhesive includes an acrylic adhesive.

39. The method of claim 37, wherein the pressure sensitive adhesive includes a rubber adhesive.

10

40. The method of claim 37, wherein the high pressure laminate comprises a top layer, a reinforcement layer, and a bottom layer.

41. A method of adhering a covering layer to a substrate comprising:
15 removing a release liner from one side of the pressure sensitive adhesive including a cross-linking agent capable of forming a covalent bond with a hydroxyl surface functionality to expose a surface of the pressure sensitive adhesive;
contacting the surface of the pressure sensitive adhesive with a surface of a substrate; and applying pressure to the pressure sensitive adhesive to form a bond between the covering
20 layer and the substrate.

42. A method of adhering a covering layer to a substrate comprising:
removing a release liner from one side of the pressure sensitive adhesive having a peel force substantial enough to cause a high pressure laminate adhered to a plywood surface to break
25 if removal of the laminate from the plywood is attempted in a temperature range of 0 to 250°F to expose a surface of the pressure sensitive adhesive;
contacting the surface of the pressure sensitive adhesive with a surface of a substrate; and applying pressure to the pressure sensitive adhesive to form a bond between the covering layer and the substrate.

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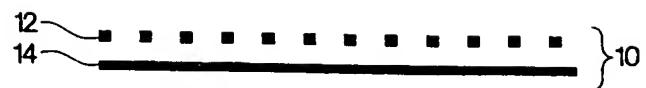


Fig. 1



Fig. 2



Fig. 3

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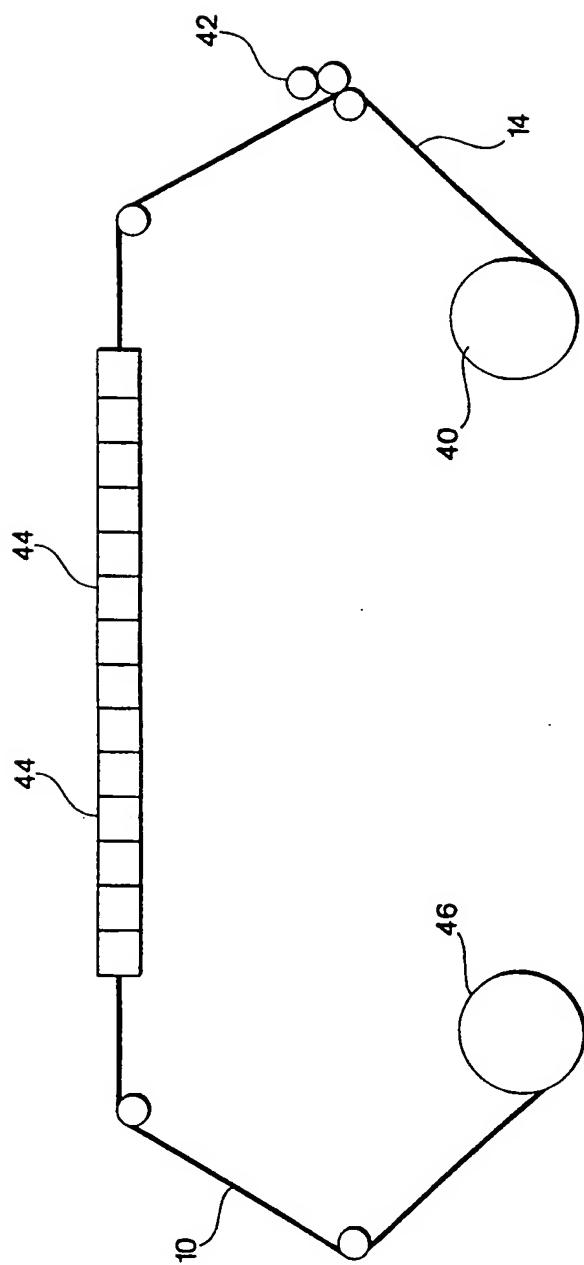


Fig. 4

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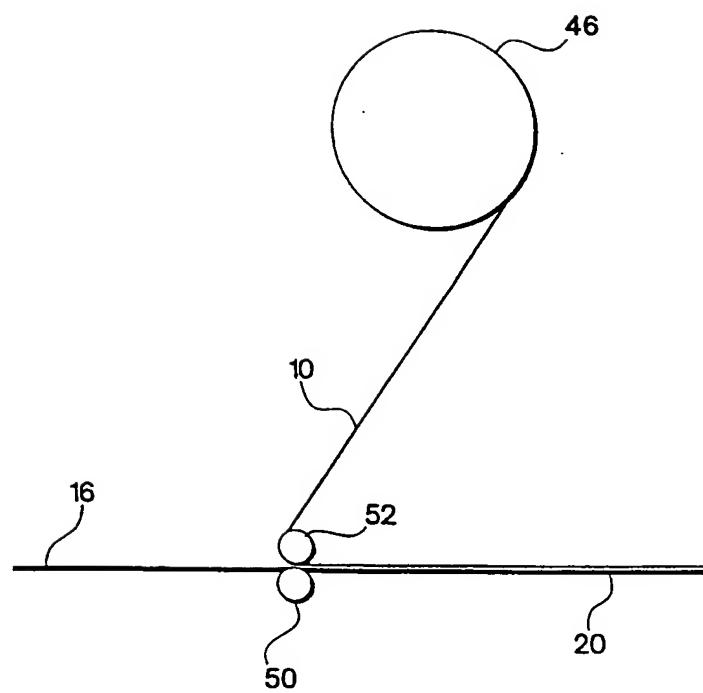


Fig. 5

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 98/11300

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C09J7/02

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C09J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 525 227 A (ROCKCOR INC) 21 October 1983 see claims	1,3,5
X	DATABASE WPI Section Ch, Week 9710 Derwent Publications Ltd., London, GB; Class A18, AN 97-103803 XP002079235 & JP 08 337764 A (OJI PAPER CO) , 24 December 1996	1,2,4,5
A	see abstract	6-42
X	US 4 038 454 A (LEHMANN G W HORST ET AL) 26 July 1977	1,2,4,5
A	see column 8; example 4 see claims	6-42
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Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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Date of the actual completion of the international search

1 October 1998

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

Intern. Search Application No

PCT/US 98/11300

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Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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